Underweight Adolescents in Northern Saudi Arabia - A Community-Based Study

Areej Muteb S. Alanazi[1], Abdalla Mohamed Bakr Ali[2], Zainab Muhammad Ibrahim Ory[3], Reem Mudhhi Essa Alanazi[1], Nujud Muteb D. Alshammari[1], Jawaher Mohammed Hassan Al Ruwaili[1], Jawaher Naif M. Althayidi[1], Waad Salamah Alaleimi[1], Rayyanah Mufadhi R. Alanazi[1], Rawan Hamdan Salem Alenazy[1], Maha Ibrahim Alanazi[1]

1 Faculty of Medicine, Northern Border University, KSA.2 Faculty of Medicine, Sohag University, Egypt
3 Pediatrics Department, Faculty of Medicine, Northern Border University, KSA

ABSTRACT

Background: Adolescence refers to the developmental period between childhood and adulthood, and the WHO defines adolescents as individuals between the ages of 10–19 years. They make up about 20% of the world population. Rapid development and urbanization of KSA has resulted in changes in nutritional and diet patterns that have affected the BMI of children and adolescents and led to nutritional transition. The objective of this study was to evaluate and estimate the weight status and prevalence of underweight in school-aged male and female adolescents in Arar city, Northern Saudi Arabia using the BMI. **Methods:** This was a cross-sectional study that has been conducted among school adolescents of both sexes, aged 12-18 years during the academic year 2015–2016 over a period of 9 months (October 1st, 2015 to June 30th, 2016). Information obtained through an interviewer administered semi-structured questionnaire. Body mass index (BMI) was calculated as per the formula BMI = weight (kg) / height(m2). Age and sex-specific BMI percentiles were computed based on the Centre for Disease Control (CDC)/National Centre for Health Statistics growth curves. **Results:** In the studied participants (n = 849), the male-female ratio was (48.1%:51.9%). About half (50.4%) of the studied adolescents had normal BMI, 25.7% were underweight (below the 5th percentile), 18.1% were overweight and only 5.8% were obese (above 95th percentile). **In conclusion;** nutritional status among adolescents is not so well. Yet more work is needed to identify the more influential factors which can improve the nutritional status among adolescents in Arar beside nutritional education programs to the mothers and/or care givers.

Keywords: Nutritional status; BMI; Adolescents**;** Underweight; Arar city; Northern Saudi Arabia

Introduction

INTRODUCTION

Adolescents growth assessment based on the Body Math Index (BMI); -weight and height-, and age in comparison to standards, references, and previous studies is internationally recommended and recognized as an important public health indicator for the monitoring of the nutritional status and health in populations[1]. Adolescence refers to the developmental period between childhood and adulthood, and the World Health Organization (WHO) defines adolescents as individuals between the ages of 10–19 years [2]. They make up about 20% of the world population [3, 4].

Stunting, defined as inadequate height for age, and wasting, defined as inadequate weight for height, are anthropometric status indicators that are commonly used for these assessments and studies. However, underweight, or inadequate weight for age, combines information about linear weight and growth retardation, and height [5]. Underweight people have a BMI of less than 18.5 or a weight 15% to 20% below that normal for their age and height group [6].

Rapid development and urbanization of the Kingdom of Saudi Arabia (KSA) has resulted in changes in nutritional and diet patterns that have affected the BMI of children and adolescents and led to nutritional transition [7, 8]. Overweight and obesity in children and adolescents are mostly associated with economic development and affluence [9]. These conditions have significantly increased in low and middle income countries (LMICs) over time. [10, 11]. Now, overweight and obesity in children and adolescents co-exist with underweight, stunting and wasting [12] that historically, were associated with the developing world. The paradox of these two extremes, known as the "double burden of malnutrition" [12, 13] coexisting and largely attributable to nutrition transition in LMICs [14], is a challenge to public health [15]. Previous studies have shown different prevalence of underweight adolescents in countries with different nutritional habits, developmental conditions and geographic distribution [16]. A study conducted in seven African countries has shown that the prevalence of being underweight in Benin, Djibouti, Egypt, Ghana, Malawi, Mauritania, and Morocco ranged from 12.6% in Egypt to as high as 31.9% in Djibouti [17]. However, **Fryar *et al*** [18]. study in the United States has shown that the prevalence of underweight children

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and adolescents aged 2-19 years in the period of 2007-2010 (NHANES) was 3.5% only [18]. A study was conducted in Callao, Peru in a randomly selected sample of 952 secondary school adolescents from 11 schools showed that the prevalence of underweight was 1.5% [19]. In Velsk district, Russia, **Khasnutdinova *et al*** [20]. study has shown that the prevalence of underweight adolescents (14-17) was 3.6% estimated according to the WHO-2007 criteria [20].

Having profiles of and understanding the prevalence and patterns of long term growth falters in children and adolescents is essential for planning and implanting the public health policy in any country [21]. Since the data on the weight status and prevalence of underweight is limited, the objective of the study was to evaluate and estimate the status and prevalence of school-aged male and female adolescents in a representative sample in Arar city, Northern Saudi Arabia using the BMI.

Participants and Methodology

The study was a cross-sectional study that has been conducted among school adolescents of both sexes, aged 12-18 years in Arar, Northern Saudi Arabia. The study was carried during the academic year 2015–2016 over a period of 9 months (October 1st, 2015 to June 30th, 2016). The formula $\mathbf{n = z^2 p (1 – p) / e^2}$ was used to estimate the sample size. Considering the prevalence of stunted growth in Arar is 50%, target population more than 1000, study power 95%, absolute error 5%, and a nonresponse rate 20%. The sample size worked out 720 school adolescents. Stratified cluster sampling was used to draw this representative sample of students from 10 randomly selected schools in the study area in classes 1st preparatory to 3rd secondary. In all, there were 38 clusters (classes) from which 21 clusters (primary sampling unit) were selected through probability proportionate to size sampling. Finally, 36 students were selected from each class using a lottery method of randomization.

Information obtained and used on relevant sociodemographic characteristics such as age, sex, father's age, mother's age, father's educational status, mother's educational status and consanguinity between parents through an interviewer administered semi-structured questionnaire.

A trained field investigator using a single electronic weighing machine recorded the weight information. Measurement was taken to the nearest 0.1 kg. For the measuring height, each study subject was made to stand against a calibrated vertical bar with a horizontal headboard. Height was recorded to the nearest 0.5 cm. Body mass index (BMI) was calculated as per the formula **BMI = weight (kg) / height (m^2).** Age and sex-specific BMI percentiles were computed based on the Centre for Disease Control (CDC)/National Centre for Health Statistics growth curves [22]. Study subjects were classified as underweight (<5th percentile of the 2000 CDC BMI-for-age growth charts), normal weight (≥5th percentile and <85th percentile), overweight (≥85th and <95th percentile), and obese (≥ 95th percentile).

Ethical considerations

Ethical approval was obtained from the Research and Ethics Committee at the Faculty of Medicine, Northern Border University, Kingdom of Saudi Arabia. Professional data collectors explained the aims and benefits of the studies run on the collected data. Written consents were obtained from all participants. Data confidentiality was maintained throughout the entire study. There was no conflict of interest.

Statistical analysis

The Statistical Package for Social Sciences (IBM SPSS), version 22 (International Business Machines Corp., NY, USA) has been utilized to analyze the study data. The results were displayed as counts and percentages. The w2 and independent sample t-tests were used as a test of significance, and differences were considered significant at P value less than 0.05.

RESULTS

Table (1) illustrates the socio-demographic characteristics, BMI, parents' education and age groups, family history of obesity and presence of chronic diseases in the studied adolescents. In the studied participants (n = 849), the male-female ratio was (48.1%:51.9%). The majority (43.5%) of the participants were 12-14 years, followed by the age groups 15-16 years, and 17-18 (28.3%). Mean age of the participants (± SD) was 14.91 (±1.95). About half (50.4%) of the studied adolescents had normal BMI, 25.7% were underweight (below the 5th percentile of the 2000 CDC BMI-for-age growth charts), 18.1% were overweight and only 5.8% were obese (above 95th percentile). About one third (31.7%) of studied participants had mothers in the age group 40-50 years and more than third (38.9%) had fathers in the age group 50-60 years. As regards parents' education, about one third (32.2%) of the studied adolescents had mothers who completed their primary education compared to (26.9%) of the fathers, 32.9% of fathers and 25.1% of the mothers had university or more education, illiteracy constitute only 4.0% of the fathers and 7.8% of the mothers. Unfortunately, 21.6% had consanguinity between parents and 15.9% had positive

family history of obesity. As regards presence of chronic diseases, 90.7% were free.

Table (2) illustrates the relationship between BMI and socio-demographic characteristics of the studied adolescents. The mean BMI of males in this study was significantly higher than that of females; 23.6 (±4.3) and 20.4 (±4.3), respectively. Underweight adolescent females were more than the underweight adolescent males (41.3% vs. 8.8%, respectively). On the other hand, obesity was more prevalent among males than females (7.6% vs. 4.1%). The normal BMI was found to be 56.4% in males and 44.9% in females. With statistically significant effect of sex, age group, parents' education, and parents' age groups ($p < 0.05$).

Table (3) illustrates family history of obesity and presence of chronic diseases, as well as consanguinity between parents among the studied adolescents. From the table, it is clear that 91.7% of the studied underweight adolescents did not have a family history of obesity. Moreover, 88.5% of the studied underweight adolescents did not have any type of consanguinity of parents. Finally, 88.5% of the studied underweight adolescents were not suffering from any kind of chronic diseases. With statistically significant effect of consanguinity between parents and family history of obesity ($p < 0.05$) and non-significant effect of presence of chronic diseases ($p > 0.05$) on the BMI of the studied adolescents.

Table (1): BMI, sociodemographic characteristics, family history of obesity and presence of chronic diseases in the studied adolescents, Arar, 2016 (n = 849)

		No. (n = 849)	Percent
Sex	Female	441	51.9
	Male	408	48.1
Age group	12-	369	43.5
	15-	240	28.3
	17-18	240	28.3
	Mean age (± SD)	14.91 (± 1.95)	
BMI	Underweight	218	25.7
	Normal	428	50.4
	Overweight	154	18.1
	Obese	49	5.8
	Mean BMI (± SD)	21.94 (± 4.6)	
Mother's age group	• 35 -	65	7.7
	• 40 -	269	31.7
	• 50 -	218	25.7
	• 55 +	88	10.4
Father's age group	• 35 -	25	2.9
	• 40 -	321	37.8
	• 50 -	330	38.9
	• 55 +	173	20.4
Father education	Illiterate	34	4
	Primary education	228	26.9
	Preparatory education	207	24.4
	Secondary education	101	11.9
	University or more	279	32.9
Mother education	Illiterate	69	7.8
	Primary education	286	32.2
	Preparatory education	218	24.5
	Secondary education	93	10.5
	University or more	223	25.1
Family history of obesity	• Yes	135	15.9
	• No	714	84.1
Consanguinity between parents	• Yes	183	21.6
	• No	666	78.4
Presence of chronic diseases	• Yes	79	9.3
	• No	770	90.7

Table (2): The relationship between BMI and sociodemographic characteristics among the studied adolescents

		No.	No.	No.	No.	No.	Chi-Square	P value
		%	%	%	%	%		
	BMI	Underweight (n=218)	Normal (n=428)	Overweight (n=154)	Obese (n=49)	Total (n = 849)		
		26%	50%	18%	6%	100%		
Sex	Female	182	198	43	18	441	1.32	0.001
		41.30%	44.90%	9.80%	4.10%	100.00%		
	Male	36	230	111	31	408		
		8.80%	56.40%	27.20%	7.60%	100.00%		
	Mean BMI (± SD)		20.4 (± 4.3) in females		23.6 (± 4.3) in males			0.001*
Age group	12-	163	173	23	10	369	138.22	0.001
		44.20%	46.90%	6.20%	2.70%	100.00%		
	15-	16	134	76	14	240		
		6.70%	55.80%	31.70%	5.80%	100.00%		
	17-18	39	121	55	25	240		
		16.20%	50.40%	22.90%	10.40%	100.00%		
Mother's education	Illiterate	22	35	5	3	65	29.59	0.003
		33.80%	53.80%	7.70%	4.60%	100.00%		
	Primary	59	136	52	22	269		
		21.90%	50.60%	19.30%	8.20%	100.00%		
	Preparatory	54	107	45	12	218		
		24.80%	49.10%	20.60%	5.50%	100.00%		
	Secondary	12	50	23	3	88		
		13.60%	56.80%	26.10%	3.40%	100.00%		
	University or more	71	100	29	9	209		
		34.00%	47.80%	13.90%	4.30%	100.00%		
Father's education	Illiterate	17	17	0	0	34	25.888	0.011
		50.00%	50.00%	0.00%	0.00%	100.00%		
	Primary	51	122	40	15	228		
		22.40%	53.50%	17.50%	6.60%	100.00%		
	Preparatory	58	95	40	14	207		
		28.00%	45.90%	19.30%	6.80%	100.00%		
	Secondary	17	61	18	5	101		
		16.80%	60.40%	17.80%	5.00%	100.00%		
	University or more	75	133	56	15	279		
		26.90%	47.70%	20.10%	5.40%	100.00%		
Mothers age group	35 -	18	16	7	1	42	19.7	0.02
		42.90%	38.10%	16.70%	2.40%	100.00%		
	40 -	121	229	80	32	462		
		26.20%	49.60%	17.30%	6.90%	100.00%		
	50-	50	146	54	13	263		
		19.00%	55.50%	20.50%	4.90%	100.00%		
	55+	29	37	13	3	82		
		35.40%	45.10%	15.90%	3.70%	100.00%		
Father's age group	35 -	16	7	2	0	25	37.56	0.001
		64.00%	28.00%	8.00%	0.00%	100.00%		
	40 -	96	150	57	18	321		
		29.90%	46.70%	17.80%	5.60%	100.00%		
	50-	62	172	72	24	330		
		18.80%	52.10%	21.80%	7.30%	100.00%		
	55+	44	99	23	7	173		
		25.40%	57.20%	13.30%	4.00%	100.00%		

* independent sample T-test was used.

Table (3): the relationship between BMI and family history of obesity, consanguinity between parents and presence of chronic diseases among the studied adolescents

BMI	Underweight (n=218)	Normal (n=428)	Overweight (n=154)	Obese (n=49)	Total (n=889)		
	No.	No.	No.	No.	No.	Chi-Square	P value
	%	%	%	%	%		
Family history of obesity							
• Yes	18	60	39	18	135	36.79	0.001
	8.30%	14.00%	25.30%	36.70%	15.90%		
• No	200	368	115	31	714		
	91.70%	86.00%	74.70%	63.30%	84.10%		
Consanguinity between parents							
• Yes	25	40	12	2	79	8.9	0.031
	11.50%	9.30%	7.80%	4.10%	9.30%		
• No	193	388	142	47	770		
	88.50%	90.70%	92.20%	95.90%	90.70%		
Presence of chronic diseases							
• Yes	25	40	12	2	79	3.21	0.36
	11.50%	9.30%	7.80%	4.10%	9.30%		
• No	193	388	142	47	770		
	88.50%	90.70%	92.20%	95.90%	90.70%		

DISCUSSION

The surveillance of physical growth of school-going adolescents in populations over time require studies and prevalence data. Malnutrition in this age group is mostly caused by the chronic effect of increasingly reported health problems which are to be looked into and continuously monitored by the school health systems in addition to the effective interventions of the parents.

The underweight prevalence, worldwide, was projected to decline from 26.5% in 1990 to 17.6% in 2015. In developed countries, the prevalence was estimated to decrease from 1.6% to 0.9% while in developing regions, the prevalence was forecasted to decline from 30.2% to 19.3%. In Asia, the prevalence was estimated to decrease from 35.1% to 18.5%. On the other hand, in Africa, the prevalence of underweight was forecasted to increase from 24% to 26.8% [17].

This cross-sectional community-based study was conducted on adolescents of both sexes, aged 12-18 years during the period from 1st October, 2015 to 30th June 2016 to evaluate the prevalence of underweight adolescents in a representative sample of preparatory and secondary school male and female students in Arar city, Northern Saudi Arabia, using the BMI, and to identify factors influencing it.

The results and outcomes of this study present unique information on trends in underweight adolescents in Arar, Northern Saudi Arabia.

In the present study, the mean BMI of males was significantly higher in males than in females; 23.6 (± 4.3), and 20.4 (± 4.3), respectively. These differences in the BMI between both sexes may be the result of increased fat free masses in males as well as increased bone bulk. Also, decreased physical activity in females may result in decreased muscle bulk which contributes to decreased weight [23].

Results of the current study revealed that 25.7% of the studied school-aged adolescents were underweight (below the 5th percentile of the 2000 CDC BMI-for-age growth charts) which is far higher than the findings of the **Alshammari *et al*** [24] study in Hail Region, Saudi Arabia who reported that underweight adolescents (13-18 years old) constituted only 1.9% of the studied group. In the study of **Abahussain** [25], the underweight Saudi adolescent girls, 15–19-years-old, living in Al-Khobar, Saudi Arabia, made up 3.6% of the collected data subjects in 2007. While the study of **Manyanga *et al*** [17]. which has been conducted in 7 different African countries, showed that the prevalence of underweight adolescents (11-17 years old) was relatively similar to our findings in Ghana (25.7%), Morocco (24.0%), Mauritania (22.3%), and Malawi

(21.1%), in contrast to the prevalence in Egypt (12.6%), Benin (17.5%), which are lower than our findings, while it is markedly increased in Djibouti (31.9%).

In the United States, the Center for Disease Control (CDC)/National Center for Health Statistics (NCHS), National Health Education Standards (NHES) and National Health and Nutrition Examination Survey (NHANES) showed that the prevalence of underweight among 12-19 years old adolescents in the period of 2007-2010 to be 6.5% which is far less than our figure, while the corresponding finding among the same age group in the 2003-2006 study was 3.8% only [18].

In the current study, the prevalence of underweight females in the study group was significantly higher than males as 41.3% of the females were underweight while only 8.8% of the males were underweight.

The results also showed that nearly half (44.2%) of the study subjects aged 12-14 years were underweight, while in the 15-16 age group only 6.7% were underweight and 16.2% in the 17-18 age group.

CONCLUSION and RECOMMENDATIONS

Nutritional status among adolescents is not so well. Yet more work is needed to identify the more influential factors which can improve the nutritional status among adolescents in Arar beside nutritional education programs to the mothers and/or care givers.

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